



(1)

INTER-OFFICE MEMORANDUM

To: GWBA

From: LAWM Date:                 

Subject: Level II Support - MoDTC

Cc: JACK, RVG, EAB, BRD, WBC, WMN, BDD

Gordon,

Attached is the Level II Support for 500 ppm Mo on top of [REDACTED]. Please forward this data to Steve and Mike at GM.

[REDACTED] is Lubrizol's general sales [REDACTED] product. The VM is Lubrizol's standard OCP. The base oils are Group 1 type.

Please note: We ran the IIE on 250 ppm Mo since at 500 ppm Mo we failed on ORLD twice, 3.09 and 3.39. All formulas were exactly the same except for the level of MoDTC. The MoDTC used was Sakura-Lube.



Lew

LAWM/mjt  
Attachment

**LEVEL 2 SUPPORT DATA FOR THE ADDITION OF MOLYBDENUM  
DITHIOCARBAMATE**

<b>Formulation</b>	<b>Baseline</b>	<b>Moly @ 500 ppm</b>
<b>Viscosity Grade</b>	<b>5W-30</b>	<b>5W-30</b>
LZ 9800TM	X	X
<b>Base Stocks</b>		
Ashland 100N	88.0	88.0
Ashland 325N	12.0	12.0
<b>Viscosity Modifier</b>		
LZ 7070	8.20	8.20
<b>Pour Point Depressant</b>		
LZ 7749B	0.20	0.20
<b>Dispersant/Inhibitor Package</b>		
TBN	5.50	5.51
%Mo		0.044
%Mg	0.023	0.023
%Na	0.024	0.024
%Ca	0.092	0.092
%SA	0.659	0.659
%P	0.092	0.092
%Zn	0.101	0.101
%N	0.064	0.065
%S	0.485	0.460
<b>CRC L-38</b>	Pass	Pass
BWL (40 mg max.)	17.2	15.4
PSV (9.0 min.)	9.80	9.80
<b>Sequence IID</b>	Pass	Pass
AER (8.46 min.)	8.52	8.65
<b>Sequence IIIE</b>	Pass	Pass*
Hours to 375% Vis. Inc. (64 min.)	73.2	73.5
AES (9.16 min.)	9.58	9.56
APV (8.86 min.)	9.03	9.26
RLD (3.46 min.)	5.47	3.53
CLWM (64 um max.)	49	12
CLWA (30 um max.)	12.9	7.0
Oil Related Stuck Rings (none)	None	None
<b>Sequence VE</b>	Pass	Pass
AES (8.96 min.)	9.36	9.29
RCS (6.96 min.)	8.64	9.16
AEV (4.96 min.)	5.86	5.43
APV (6.46 min.)	6.82	7.39
CWM (15 um max.)	0.80	8.5
CWA (5 um max.)	1.03	3.87

\* = % molybdenum = ~250 ppm.

## LEVEL 4 SUPPORT DATA FOR THE ADDITION OF MOLYBDENUM

## DITHIOCARBAMATE

Formulation	Baseline	Moly @ 500 ppm	Baseline	Moly @ 500 ppm
Viscosity Grad	5W-30	5W-30	5W-30	5W-30
OS Number	115072	128465	1131-108549	685-40120
Base Stocks				
Ashland 100N	88.0	88.0	90.0	90.0
Ashland 325N	12.0	12.0	10.0	10.0
Viscosity Modifier				
LZ 7070	8.20	8.20	8.10	8.10
Pour Point Depressant				
Viscoplex 1-330	-	-	0.20	0.20
LZ 7749B	0.20	0.20	-	-
Dispersant/Inhibitor Package				
TBN	5.50	5.51	5.12	5.10
%Mo	-	0.044	-	0.046
%Mg	0.023	0.023	0.037	0.037
%Na	0.024	0.024	0.059	0.059
%Ca	0.092	0.092	0.048	0.048
%SA	0.659	0.659	0.688	0.688
%P	0.092	0.092	0.095	0.095
%Zn	0.101	0.101	0.105	0.105
%N	0.064	0.065	0.053	0.053
%S	0.485	0.460	0.485	0.505
CRC L-38	Pass	Pass		
BWL (40 mg max.)	17.2	15.4		
PSV (9.0 min.)	9.80	9.80		
Sequence IID	Pass	Pass		
AER (8.46 min.)	8.52	8.65		
Sequence IIIE	Pass	Pass*		
Hours to 375% Vis. Inc. (64 min.)	73.2	73.5		
AES (9.16 min.)	9.58	9.56		
APV (8.86 min.)	9.03	9.26		
RLD (3.46 min.)	5.47	3.53		
CLWM (64 um max.)	49	12		
CLWA (30 um max.)	12.9	7.0		
Oil Related Stuck Rings (none)	None	None		
Sequence VE	Pass	Pass		
AES (8.96 min.)	9.36	9.29		
RCS (6.96 min.)	8.64	9.16		
AEV (4.96 min.)	5.86	5.43		
APV (6.46 min.)	6.82	7.39		
CWM (15 um max.)	0.80	8.5		
CWA (5 um max.)	1.03	3.87		
Sequence VIA	Pass		Fail	Pass
EFEI (1.06 min. for 5W-30)	1.13		0.99	1.33

\* = % molybdenum = ~250 ppm.

age: 1 Document Name: untitled

(2)

WOQ1 THE LUBRIZOL CORPORATION  
INQUIRY SCREEN  
BLEND REQUEST/MATERIAL DEFINITION

Material Name S010-4514-94-15, OS Number . . OS128465

Enterer . . . RKW	Entry Date	[REDACTED]	Record Type	S
Requestor . . . MW	Calc Unit . .	W	CM Type . . .	BL
Priority . . . A	Blend Amount	82400 G		
Need By Date	Amt to Stock	33281 G	Picklist Stat	PICK

Project . . . T944514	Market Class	A	Blender	SAAB
Subset . . . 15	QA Approved		Blend Date	[REDACTED]
CMA# . . . Y	Maj/Min Mods	00 A	RM-4514940015-A-1	

Invent Date [REDACTED]	Inventor . . .	MW	Invent Dept	5240 WKF
Perf Grade				
Visgrade . . . 5W-30	Visgr Source	SAE		
Waste Track R NSW	7		Release Flag	N

LZ Product

Press ENTER to Continue  
000INFN Display successful

F1: Help

F3: Main Menu

F4: Previous

P/N

RESEARCH TEST RESULT (SCARD)

DATE: 07/15/03

PRODUCT: S010-4514-94-15,  
AS OF 1/1/2000, USE MCR. ONLY HISTORICAL DATA WILL BE AVAILABLE IN WOBC

(3)

## REMARKS:

1. REPLACED DISTRIBUTION DURING BREAK-IN.

CMA NO: RM-4514940015-A-1-VE-1-LZ-247  
CHEM MATL NAME: S010-4514-94-15, OS NO: OS128465  
TEST NAME: W080.045.07 COMP DATE: [REDACTED] DESC: SEQ.VE DEVL.  
RUN NUMBER: 1 LOCATION: WICKLIFFE  
VALIDITY: VALID QUALIFIED: QUALIFIED

ID NUMBER: 247-5-41 FUEL BATCH: 43  
TEST HOUR: 288.0 ENGINE NO: 81-94-  
PASS/FAIL: PASS

SLUDGE DEPOSITS	RATING	RESULT	ADJUSTED	VARNISH DEPOSITS	RATING	RESULT	ADJUSTED
ROCKER ARM COVER	9.16	9.16	[REDACTED]	PISTON SKIRTS	7.39	7.39	[REDACTED]

ENTER - NEXT PAGE, P/-1 - PREVIOUS PAGE, CLEAR - EXIT TRANSACTION

ge: 1 Document Name: untitled

(4)

0Q5

THE LUBRIZOL CORPORATION  
INQUIRY SCREEN  
FORMULA AT ACTUAL STATE

07/18/03  
15:42:38

Material Name	S010-4514-94-15,	OS Number	OS128465			
Calc Unit . .	W CM	Type	BL			
<u>Ingredient</u>		Pct/PPM	Use	Pct W	Pct V	OS#
265-X6052,P	BASE STOCKS	88.0000	B	71.1920	72.0649	OS75287Y
265-X6047,H		12.0000	B	9.7080	9.6219	OS75863K
S762-4513-94-134,S		8.2000	O	8.2000	8.2866	OS115849L
S762-4850-94-718,B		0.2000	O	0.2000	0.1922	OS118095C
S010-4514-94-14,- CONC		10.7000	O	10.7000	9.8344	

Press ENTER to continue

WOQ5MSGIN Actual information displayed successfully.

F1: Help F3: Main Menu F4: Previous

ge: 1 Document Name: untitled

(5)

NOQ6

THE LUBRIZOL CORPORATION  
INQUIRY SCREEN  
THEORETICAL ANALYSIS

07/18/03  
15:41:55

Material Name 265-X6052,P

OS Number OS75287Y

Waste Tracking Number R NSW 7

Ela Name . . . 265-X6052

%Oil	100.0000	%Ca	%S	.2000	%Mo
Sp.Gr	.8644	%Mn	%N	.0020	%Pb
TBN		%Co	%B		%K
TAN		%Mg	%Cu		%Na
%SA		%Ba	%Cl		%Sr
%Zn		%P	%Li		%Si

Title Title Name . . . 265-X6052

\* (MT) VALVOLINE/ASHLAND CATLETTSBURG 100N HT \*USE DIL OIL

Press ENTER to continue

000INFN Display successful

F1: Help - F3: Main Menu

F4: Previous

ge: 1 Document Name: untitled

(6)

WOQ6

THE LUBRIZOL CORPORATION  
INQUIRY SCREEN  
THEORETICAL ANALYSIS

07/18/03  
10:09:46

Material Name 265-X6047, H  
Waste Tracking Number R NSW 7  
Ela Name . . . 265-X6047

OS Number OS75863K

%Oil	100.0000	%Ca	%S	.3900	%Mo
Sp.Gr	.8820	%Mn	%N	.0040	%Pb
TBN		%Co	%B		%K
TAN		%Mg	%Cu		%Na
%SA		%Ba	%Cl		%Sr
%Zn		%P	%Li		%Si

Title Title Name . . . 265-X6047, H  
VALVOLINE, INC.

Press ENTER to continue

000INFN Display successful

F1: Help F3: Main Menu

F4: Previous

Age: 1 Document Name: untitled

(7)

WOQ5

THE LUBRIZOL CORPORATION  
INQUIRY SCREEN  
FORMULA AT ACTUAL STATE

07/18/03  
15:43:18

Material Name S010-4514-94-14,  
Calc Unit . . W CM Type CN  
. Ingredient Pct/PPM Use Pct W Pct V OS#  
S015-4041-94-17,J 9.5000 O 88.7850 87.8868 OS115020C  
S217-8226-95-01,C 1.2000 O 11.2150 12.1132

Press ENTER to continue  
WOQ5MSGIN Actual information displayed successfully.  
F1: Help F3: Main Menu F4: Previous

(8)

ge: 1 Document Name: untitled

WOQ3

THE LUBRIZOL CORPORATION  
INQUIRY SCREEN  
RECEIVE OUTSIDE MATERIAL07/18/03  
15:44:30

Material Name	S217-8226-95-01, ←	OS Number	OS117924	
Enterer . . .	KJL	Requestor . . .		
Project . . .	T958226	Record Type . . .	S	
Subset . . .		CM Type . . .	UN	
CMA # . . .		Invent Date . . .	[REDACTED]	
Receipt Date		Document Type		
Receipt Amount	1.000	U/M      G	Document Number	
Supplier . . .	TONEN		Inv Amount	1
Supp Batch Id				
Visgrade . . .		Visgr Source	Waste Track R	NSW
SpGr . . . .	.8800	MSDS Avail ?	Competitive Mat	7
Blend Title	MO-DTC SAKURA LUBE #100 ←			

Comment . . . TONEN

LZ Material

Press ENTER to Continue

000INFN Display successful

F1: Help

F3: Main Menu

F4: Previous

age: 1 Document Name: untitled

(9)

WOQ6

THE LUBRIZOL CORPORATION  
INQUIRY SCREEN  
THEORETICAL ANALYSIS

07/18/03  
15:44:46

Material Name S217-8226-95-01,  
Waste Tracking Number R NSW  
Ela Name . . . S217-8226-95-01

OS Number OS117924

7

%Oil	80.0000	%Ca	%S	4.1600	%Mo	4.1500
Sp.Gr	.8800	%Mn	%N		%Pb	
TBN	1.7000	%Co	%B		%K	
TAN		%Mg	%Cu		%Na	.0090
%SA	6.2528	%Ba	%Cl		%Sr	
%Zn		%P	.0160	%Li		%Si

Title                              Title Name . . . S217-8226-95-01,  
TONEN

Press ENTER to continue  
000INFN Display successful  
F1: Help                        F3: Main Menu                        F4: Previous

WOQ5

THE LUBRIZOL CORPORATION  
INQUIRY SCREEN  
FORMULA AT ACTUAL STATE07/18/03  
15:45:19

Material Name	S015-4041-94-17,	OS Number	OS115020		
Calc Unit . .	W	CM Type	CN		
Ingredient	Pct/PPM	Use	Pct W	Pct V	OS#
-C	4.0300	O	42.4210	44.5216	OS48147K
	0.8600	O	9.0526	10.0707	
	1.3700	O	14.4211	14.8903	OS28802Y
-d	0.9200	O	9.6842	7.7467	
- e-1	0.6800	O	7.1579	7.3149	OS128676
- e-2	0.3000	O	3.1579	3.1944	OS47056H
	0.5100	O	5.3684	4.7312	
	0.3800	O	4.0000	3.3994	OS45933AA
	0.2000	O	2.1053	1.8676	OS101888A
	0.2500	O	2.6316	2.2632	OS84147F
	90.0000	T	0.0947	0.1101	

Press ENTER to continue

WOQ5MSGIN Actual information displayed successfully.

F1: Help      F3: Main Menu      F4: Previous

(11)

Lubrizol Confidential

## Intermediate Chemical Information

Last Updated: 23JUL03

**Generic Name:** Polyolefin amide alkeneamine**MSDS Chemical Name(s):** Polyisobutylene succinic anhydride, product with polyethylenamines**Primary End Use(s):** DISPERSANT**Secondary End Use(s):** VISCOSITY INDEX IMPROVER**LZ Product Numbers:** [REDACTED]**Waste Tracking Number:** R-NSW-7**Functional Structures**

- SUCCINIMIDE
- SUCCINIMIDE, FROM CHLORINE SUCCAN
- SUCCINIMIDE, CO:N(1/0.83)=(6/5) EG [REDACTED]

**Backbone Structures**

- ALIPHATIC
- BRANCHED
- MOLECULAR WT SIDE CHAIN 1601-3000 (PBU)
- MOLECULAR WT SIDE CHAIN NUMBER AVERAGE
- OLEFINIC (DIENE, ALKYNE, ETC)
- POLYMER
- POLYMER, BUTYLENES
- POLYMER, HOMOPOLYMER

**Elementals - Theory**

%B	0	%CO		%MG		%NA		%SI	
%BA		%CU		%MN		%P		%SR	
%CA		%K		%MO		%PB		%ZN	0
%CL	0.3	%LI		%N	0.9	%S	0		

**Other Characteristics - Theory**

%Sulfonate	Conv_Sulfonate		%Sulfated Ash	
%Salicylate			ZDP Primary %P	
%Phenate	Conv_Phenate		ZDP Secondary %P	
%Carboxylate	Conv_Carboxylate		ZDP Aromatic %P	
%Thiosulfate	Conv_Thiosulfate			
%Oil	55	Specific Gravity	0.91	TBN
				15

(12)  
d ~ [REDACTED]*Lubrizol Confidential*

## Intermediate Chemical Information

Last Updated: 23JUL03

Generic Name: Zinc alkyldithiophosphate

MSDS Chemical Name(s): Zinc O,O-di(1-methylethyl 1,3 dimethylbutyl) dithiophosphate

Primary End Use(s): ANTIOXIDANT, ANTIWEAR AGENT

LZ Product Numbers: [REDACTED]

Waste Tracking Number: R-CRCD-L

## Functional Structures

- CONV = 100-150 / NEUTRALS (EG [REDACTED])
- DITHIOPHOSPHATE (DTP)
- DITHIOPHOSPHATE, SALT \*
- DITHIOPHOSPHATE, SECONDARY
- SALT, ZINC

## Backbone Structures

- ALIPHATIC
- BRANCHED
- MOLECULAR WT SIDE CHAIN UNDER 169 (

## Elementals - Theory

%B		%CO		%MG		%NA		%SI	
%BA		%CU		%MN		%P	10	%SR	
%CA		%K		%MO		%PB		%ZN	11.05
%CL	0.0001	%LI		%N		%S	21		

## Other Characteristics - Theory

%Sulfonate		Conv_Sulfonate		%Sulfated Ash	16.575
%Salicylate				ZDP Primary %P	0
%Phenate		Conv_Phenate		ZDP Secondary %P	10
%Carboxylate		Conv_Carboxylate		ZDP Aromatic %P	0
%Thiosulfate		Conv_Thiosulfate			
%Oil	9	Specific Gravity	1.2	TBN	5

e-1

13

Lubrizol Confidential

## Obsolete Intermediate Chemical Information

Last Updated: 23JUL03

**Generic Name:** Alkaryl amine**MSDS Chemical Name(s):** Dinonyldiphenylamine**Primary End Use(s):** ANTIOXIDANT**Performance Synonyms:** 1050-4367, S348-6531-86-12, A755-630-L-80, PRIOLUBE 3999, 1131-88924, OTU-38**Waste Tracking Number:** R-HZL DFLT-R**Functional Structures**

- AMINE, AROMATIC
- AMINE, MONO
- AMINE, SECONDARY

**Backbone Structures**

- AROMATIC
- BRANCHED
- INHIBITOR - AMINE
- MOLECULAR WT OVERALL 282-519 (>C20-C37)
- MOLECULAR WT SIDE CHAIN UNDER 169 (

**Elementals - Theory**

%B		%CO		%MG		%NA		%SI	
%BA		%CU		%MN		%P		%SR	
%CA		%K		%MO		%PB		%ZN	
%CL	0.015	%LI		%N	3.2	%S			

**Other Characteristics - Theory**

%Sulfonate		Conv_Sulfonate		%Sulfated Ash	
%Salicylate				ZDP Primary %P	
%Phenate		Conv_Phenate		ZDP Secondary %P	
%Carboxylate		Conv_Carboxylate		ZDP Aromatic %P	
%Thiosulfate		Conv_Thiosulfate			
%Oil	12	Specific Gravity	0.94	TBN	120

e-2

14

Lubrizol Confidential

Obsolete Intermediate Chemical  
Information

Last Updated: 23JUL03

**Generic Name:** Olefin sulfide**MSDS Chemical Name(s):** Alkyl(C12-C18) sulfide**Primary End Use(s):** ANTIOXIDANT**Secondary End Use(s):** ANTIWEAR AGENT**Waste Tracking Number:** R-NHW-1**Functional Structures**

- SULFIDE, UNKNOWN (EG SULFURIZED OLEFINS)
- ALIPHATIC
  - BRANCHED
  - INHIBITOR - SULFURIZED OLEFIN
  - MOLECULAR WT SIDE CHAIN 169-225(C12-C16)

**Backbone Structures****Elementals - Theory**

%B		%CO		%MG		%NA		%SI	
%BA		%CU		%MN		%P		%SR	
%CA		%K		%MO		%PB		%ZN	
%CL	0.5	%LI		%N		%S	19		

**Other Characteristics - Theory**

%Sulfonate		Conv_Sulfonate		%Sulfated Ash	
%Salicylate				ZDP Primary %P	
%Phenate		Conv_Phenate		ZDP Secondary %P	
%Carboxylate		Conv_Carboxylate		ZDP Aromatic %P	
%Thiosulfate		Conv_Thiosulfate			
%Oil	15	Specific Gravity	0.95	TBN	0